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ORIGINAL ARTICLE

Acceptance and commitment therapy as an adjunct to the *MOVE!* programme: a randomized controlled trial

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Summary

Objective

The current study tested the efficacy of an acceptance and commitment therapy (ACT) group intervention for disinhibited eating behaviour as an adjunct to the Veterans Affairs *MOVE!*© weight management programme.

Methods

Veterans (N = 88) with overweight or obesity who completed the *MOVE!* weight management programme and self-identified as having problems with 'stress-related eating' were randomized to four 2-h weekly ACT sessions or a continued behavioural weight-loss (BWL) intervention. Assessments were completed at baseline, post-treatment and 3- and 6-month follow-up on outcomes of interest including measures of disinhibited eating patterns, obesity-related quality of life, weight-related experiential avoidance and weight.

Results

The BWL group exhibited significantly greater reductions in binge eating behaviour at post-treatment compared with the ACT group. Significant improvements in other outcomes were found with minimal differences between groups. In both groups, decreases in weight-related experiential avoidance were related to improvements in binge eating behaviour.

Conclusions

Taken together, the continued BWL intervention resulted in larger improvements in binge eating behaviour than the ACT intervention. The two groups showed similar improvements in other disinhibited eating outcomes. Future studies are encouraged to determine if more integrated or longer duration of ACT treatment may maximize eating outcomes in *MOVE*.

Trial Registration Number: This trial was registered with ClinicalTrials.gov database (NCT01757847).

Keywords: Acceptance and commitment therapy, binge eating, obesity, veterans.

Introduction

The spectrum of dysregulated eating behaviour, including objective binge eating, subjective binge eating, overeating, loss of control eating and emotional eating, has been conceptualized as a pattern of disinhibited eating (1) or uncontrolled eating (2). The range of disinhibited eating is prevalent among US military veterans with estimates ranging from nearly 26% for loss of control eating (3) to 22% for two or more episodes of binge eating (4). Some studies have reported significantly higher rates of these eating patterns among male compared with female

veterans (4,5). Additionally, disinhibited eating patterns may impede weight loss and increase risk of weight regain (6) and are associated with poor psychological and physical functioning, low health-related and obesity-related quality of life and medical and psychiatric comorbidities (7–11).

Disinhibited eating patterns in veterans may be influenced by conditions and norms specific to military service, such as being required to eat quickly, eating in response to periods of deprivation and repeated exposure to stressors (12). A survey of 642 male veterans found military-related trauma was uniquely related to eating disorder symptoms including binge eating behaviour (13). Rates of depression and post-traumatic stress disorder are significantly higher in veterans compared with civilians, and increased symptoms of both have been associated with increased disinhibited eating including binge eating (3,8,14). Given the high rates of disinhibited eating in veterans and their increased risk of comorbidities, it is imperative to evaluate how interventions impact disinhibited eating in veterans with overweight or obesity.

Obesity is a national epidemic, especially among US veterans with an estimated prevalence of 41% (15) and increasing to 44% in Fiscal Year 2018 according to recent internal Veterans Health Administration (VHA) records. In 2006, VHA implemented *MOVE!*©: a comprehensive, evidence-based multidisciplinary weight management and health promotion programme (16), and then expanded the programme with TeleMOVE (*MOVE!* materials and monitoring available at home through a telehealth monitor) and other options in order to increase the availability and reach of the programme. Although the programme initially was not designed to treat binge or other disinhibited eating behaviour, psychoeducational materials related to eating were developed to allow clinicians to address these behaviours as needed. More recently, the disproportionately high representation of men in the VHA who report eating concerns has underscored the unique opportunity to evaluate psychological treatments for disinhibited eating in men (17) who are typically under-represented in treatment studies of eating disorders.

Acceptance and commitment therapy (ACT) is an evidence-based intervention that has been effective in improving outcomes across a wide range of conditions (18). According to ACT, psychological and behavioural problems may occur as a result of experiential avoidance or an unwillingness to experience unwanted internal events like thoughts, feelings and physical sensations (18). In order to reduce experiential avoidance, the ACT approach uses mindfulness and acceptance strategies to identify valued life directions (e.g. health and family) and increase behaviour patterns (e.g. healthy eating and physical activity) in support of those values. Weight loss and maintenance require the ability to tolerate difficult or unwanted experiences (e.g. cravings, frustration and stress) (19). Emotional and other forms of disinhibited eating can be conceptualized as a maladaptive means to cope with unwanted emotional and psychological experiences, which in turn may hamper weight-loss efforts (20). Additionally, there is some research suggesting that in adults with overweight and obesity, increased experiential avoidance is associated with increased binge eating severity (21) and disinhibited eating (22). Thus, an ACT approach to disinhibited eating as an adjunct to a weight-loss programme may help reduce problematic eating behaviours and improve related health outcomes, even in individuals without a primary mental health diagnosis.

A recent pilot study of an ACT-based behavioural intervention for binge eating disorder in adult primarily female participants showed promise for decreasing experiential avoidance and binge frequency (23). Additionally, two recent trials comparing ACT-based treatment with standard behavioural interventions for weight loss in adult primarily female participants found greater weight reduction with the ACT-based intervention, especially in those with emotional or disinhibited eating (24,25). While these studies of ACT strategies incorporated into behavioural treatments for binge eating, disinhibited eating or weight loss in civilian women show promise, the results may not be directly applicable to veterans who are primarily male. This is important, given that nearly a quarter of veterans report some form of disinhibited eating (3,4). Additionally, veterans seeking treatment for obesity or disinhibited eating are typically in their 50s and 60s (26), and veterans differ from individuals in the community due to their military experience and their increased risk of physical and mental health comorbidities (27). All of these factors may impact the required treatment approach for veterans and the acceptability of interventions that are developed and tested primarily with female civilians. Finally, while previous investigations have evaluated adjunctive cognitive–behavioural treatments to behavioural weight management interventions for binge eating behaviour (28), there are no studies of ACT as an adjunctive approach for disinhibited eating (including binge eating) in obesity.

The current study was a randomized controlled trial comparing an ACT group intervention for disinhibited eating with a continued behavioural weight-loss (BWL) group intervention in veterans with overweight or obesity that recently completed *MOVE!*. Veterans who completed the *MOVE!* programme and reported experiencing 'stress-related eating' were enrolled. The focus on stress eating was so that veterans with a range of disinhibited eating could be identified. Binge eating was conceptualized as one variant of the range of disinhibited eating construct,

and outcomes included measures of binge eating and other disinhibited eating. The hypotheses were that (1) veterans in the ACT group would experience significantly greater improvements in disinhibited eating behaviour (e.g. binge eating and emotional eating), obesity-related quality of life and weight-related experiential avoidance and (2) improvement in weight-related experiential avoidance would be related to decreases in binge eating behaviour only among participants in the ACT group. Given the brief nature of the adjunctive intervention, we examined weight as an exploratory distal outcome.

Methods

Participants and procedures

Participants

Participants were US veterans that recently completed *MOVE!* at Veterans Affairs San Diego Healthcare System (VASDHS). Inclusion criteria were (1) ages 18–75, (2) body mass index (BMI) $\geq$ 25 kg m^{-2} and (3) attended at least five of eight *MOVE!* group sessions or the equivalent for TeleMOVE participation. Exclusion criteria were (1) serious or unstable medical or psychiatric illness (e.g. unmanaged psychosis, substance abuse, anorexia and bulimia) or psychosocial instability that could compromise study participation; (2) conditions in which exercise or weight loss could be detrimental to health (e.g. pregnancy); (3) active suicidal ideation or history of suicide attempt within 5 years; (4) pharmacotherapy for obesity (e.g. Orlistat) or bariatric surgery within the past 6 months or planning for such in the next 6 months; (5) current participation in group or individual psychotherapy for weight management or binge eating; (6) previous treatment with ACT; and (7) unwillingness to keep consistent mental health treatment for the study duration. Participants were not required to meet a minimum threshold of binge nor other disinhibited eating severity, and those who self-reported problems with 'stress-related eating' were enrolled in order to capture the breadth of problematic eating behaviour. The study was approved by the VASDHS Institutional Review Board and Research and Development Committee; informed consent was obtained from all participants.

Study procedures

Methods and procedures were consistent with CONSORT guidelines for conducting and reporting randomized clinical trials (29). Staff attended group intakes and the last class of *MOVE!* to provide information about the study and recruit participants. At the time of this study, the *MOVE!* programme at VASDHS consisted of either eight weekly in-person group sessions or a 90-d TeleMOVE programme, both focused on education about the risks of obesity and benefits of healthy weight management, dietary and fitness goal setting and managing food cravings and triggers (www.move.va.gov). The vast majority of veterans participated in the in-person groups during that time period. Following completion of *MOVE!*, potential participants were screened on the telephone using the Mini International Neuropsychiatric Interview (30). Eligible participants were invited for an in-person evaluation and completed the Eating Disorder Examination Edition 16.0 (31) and a physical assessment. Participants completed assessments at baseline, post-treatment and 3- and 6-month follow-up administered by staff blind to treatment condition. Participants were randomized to groups in order to minimize delays between recruitment and treatment using a Statistical Package for the Social Sciences-generated block randomization sequence established prior to recruitment and provided by a blinded statistician who was not involved with other aspects of the study. Both treatments were delivered in four 2-h weekly group sessions. Participants in both groups were informed the purpose of the study was to help them better understand the relationship of stress and other emotions with their eating and as a result improve their overall health, eating and weight. Table 1 provides a brief outline of the ACT and BWL intervention protocols (full protocols are available upon request).

Interventions

Acceptance and commitment therapy group intervention

The ACT protocol was informed by previous ACT studies (32,33) and modelled on an 8-week ACT protocol that was clinically piloted in the VASDHS Behavioral Medicine programme (34). The goal of the ACT intervention was to use mindfulness and acceptance strategies to address experiential avoidance in the context of eating behaviour and factors such as cognitions, stress, other emotions and bodily sensations that may lead to binge or other disinhibited eating. Consistent with the ACT model, sessions focused on limitations of previous efforts to control or eliminate stress or negative emotions; changing expectations and the goal of treatment from elimination of negative emotion and experiences to living as well as possible with such feelings; exercises to increase awareness and acceptance of present-moment experiences related to eating and other experiences; and the identification of personal values and setting and pursuing

Table 1 Outline of ACT and BWL intervention protocols

	ACT group	BWL group
Session 1	• What to expect: sludge in glass metaphor • Stress, emotions and eating • Limits of control: pushing against clipboard exercise and man in the hole metaphor • Mindfulness exercise: mindful eating • Homework: mindful eating practice and ACT daily diary	• The basics of weight control • Changing eating habits (portion control and eating regularly) • Healthy plate • Supportive discussion • Homework: food and activity log
Session 2	• Mindfulness exercise: body scan • Control is the problem: tug of war metaphor and ice cream mindfulness exercise • Willingness and acceptance as an alternative to control: Joe the bum metaphor • Values clarification: Lifetime contribution award exercise and stand and commit to values statement • Homework: Valued Living Questionnaire, bold move, mindfulness walking practice and ACT daily diary	• Benefits of physical activity • Frequency, intensity, time and type of physical activity • Barriers to physical activity • Supportive discussion • Homework: food and activity log
Session 3	• Mindfulness exercise: mindful breathing • Values clarification: Valued Living Questionnaire • Cognitive defusion and self as context: milk, milk, milk exercise and chessboard metaphor • Values and committed action: passengers on the bus exercise and bold move • Homework: bold move, mindfulness practice and ACT daily diary	• Changing your thinking about food, exercise and yourself • Taking control of your thoughts, feelings and behaviour • Stress and anxiety management • Supportive discussion • Homework: food and activity log
Session 4	• Mindfulness exercise: five senses • Self-as-context: the observer self-exercise and self-compassion exercise • Barriers to valued living: path up the mountain metaphor • Stand and commit to group	• Change your behaviour • Motivation • Handling weight plateaus • Wellness • Supportive discussion

Both protocols included introductions and a review of group rules in session 1.
ACT, acceptance and commitment therapy; BWL, behavioural weight-loss.

goals consistent with those values. Using an ACT approach, veterans were taught to notice thoughts, emotions and urges related to eating and to allow their values to drive behaviour rather than avoidance of negative internal experiences. The intervention also stressed the importance of at-home assignments to develop skills taught in session.

Behavioural weight-loss group intervention

The BWL intervention protocol was developed using some of the handouts and materials used in the group *MOVE!* programme at VASDHS and therefore had similar content to *MOVE!*. Given that the BWL intervention was the control condition, the study protocol was not designed to directly address disinhibited eating but contained standard behavioural weight-loss strategies such as changing eating habits, including portion control and regular eating as the means to address eating behaviour. The study protocol included a psychoeducational component using *MOVE!* handouts to reinforce relevant information from the medical, nutrition and weight-loss strategies taught in *MOVE!*. The programme also incorporated cognitive–behavioural techniques to target distorted thinking related to food consumption and physical activity, as well as strategies to maintain treatment gains (e.g. goal setting, focusing on strengths and being optimistic). Additionally, participants completed food and exercise logs.

Treatment integrity

To ensure that both treatments were delivered consistently throughout the study, all treatment sessions (56 sessions per treatment) were videotaped. A random sample of 12 sessions per treatment (21% of all sessions), divided equally across therapists, were reviewed by individuals with extensive training in ACT and the *MOVE!* programme. Tapes were coded for therapist competence as well as adherence to the therapeutic model using a modified version of the rating system that was developed for a comparable ACT study (35). Four therapists

delivered ACT (one full-time staff psychologist, two psychology postdoctoral fellows and one psychology master's student), and three delivered BWL (one full-time staff psychologist, one psychology postdoctoral fellow and one psychology master's student). ACT therapists had received previous training in ACT and attended weekly supervision.

Outcome measures

The Binge Eating Scale (BES) was used to assess binge eating severity (36). This measure contains 16 questions describing both behavioural and emotional manifestations of a binge episode and is used extensively in research to measure binge eating severity. The BES has good internal consistency and test–retest reliability in overweight and obese individuals (36). A score of 18 or higher is indicative of clinically significant binge eating (37).

The Dutch Eating Behavior Questionnaire (DEBQ) is a 33-item self-report scale containing three subscales, *emotional eating* (13 items), *external eating* (10 items) and *restraint* (10 items) (38). Items on the DEBQ range from 1 (*never*) to 5 (*very often*), with higher scores indicating greater endorsement of the eating behaviour. The three-factor structure of the DEBQ has been supported (39), and the subscales demonstrate good internal consistency (0.79–0.96) across weight category groups (normal weight, overweight and obese) (40).

The Obesity-Related Well Being Scale (ORWELL-97) is a reliable self-report measure of obesity-related quality of life (9) and is well-validated in overweight and obese patients. The measure includes 18 items that measures intensity and subjective relevance of obesity-related physical and psychosocial distress. The intensity and relevance of each item are first multiplied and then summed into a single score with higher scores indicating lower quality of life.

The Acceptance and Action Questionnaire for Weight-Related Difficulties (AAQ-W) is a 20-item questionnaire of weight-related experiential avoidance towards thoughts related to food as control, weight as a barrier to living and weight stigma (41). The AAQ-W has been shown to be sensitive to changes in attitudes around weight that occur during ACT interventions (42). Higher scores on the AAQ-W indicate more experiential avoidance, and lower scores are indicative of psychological flexibility.

Expectancy after the first intervention session was measured with the Credibility and Expectations for Improvement Scale, which is designed to assess how logical the intervention seems and how much the participant expects to benefit (43). Individual items on this measure are transformed to standardized scores (*z*-scores) and summed into two subscales: credibility and expectancy. Satisfaction after the completion of the intervention was measured with the Client Satisfaction Questionnaire (44).

Statistical analyses

Intent-to-treat analyses included participants randomized to either the ACT or BWL group with a baseline assessment and at least one additional assessment. Treatment groups were compared across baseline characteristics using analysis of variance for continuous measures and chi-squared analyses for categorical variables. Linear mixed-effects models were used to address the first hypothesis by comparing ACT and BWL on outcomes over time. Models included group (ACT vs. BWL), time and the group-by-time interaction as fixed effects. Both the intercept and the slope were considered random effects. To address the second hypothesis, PROCESS was used to determine if the relationship between change in AAQ-W and change in BES scores from baseline through 6-month follow-up differed by group (45). All statistical analyses were performed using the Statistical Package for the Social Sciences version 24 (IBM, Armonk, NY), and the α level was set at 0.05.

Results

Figure 1 provides a detailed flow chart on randomization, assessment and treatment completion. A total of 150 veterans completed screening. Of these, 28 were excluded for unstable mental health (n = 16), participating in other weight-loss treatment (n = 9), not completing *MOVE!* (n = 2) and not meeting age criteria (n = 1); an additional 34 declined to participate for time constraints (n = 9), lack of interest (n = 8), personal reasons (n = 7), unable to contact (n = 7), self-reported health concerns (n = 2) and transport difficulty (n = 1). A total of 88 participants were randomized to ACT (n = 45) or BWL (n = 43) and completed the baseline assessment; 43 (96%) completed the ACT intervention, and 42 (97%) completed the BWL intervention. Only one person from the intent-to-treat sample was lost to follow-up at 6 months.

Table 2 displays baseline characteristics. The majority of the sample was male (76.1%) with a mean age of 57.3 (standard deviation [SD] = 9.9) and mean weight of 248.5 lbs (SD = 57.9) at baseline. The only significant group difference at baseline was in education; the ACT group had more participants with technical/vocational school and professional/graduate degrees and fewer participants with bachelor's degree than the BWL group. Average BMI was 37.2 kg m^2 (SD = 7.0), with 91% of the

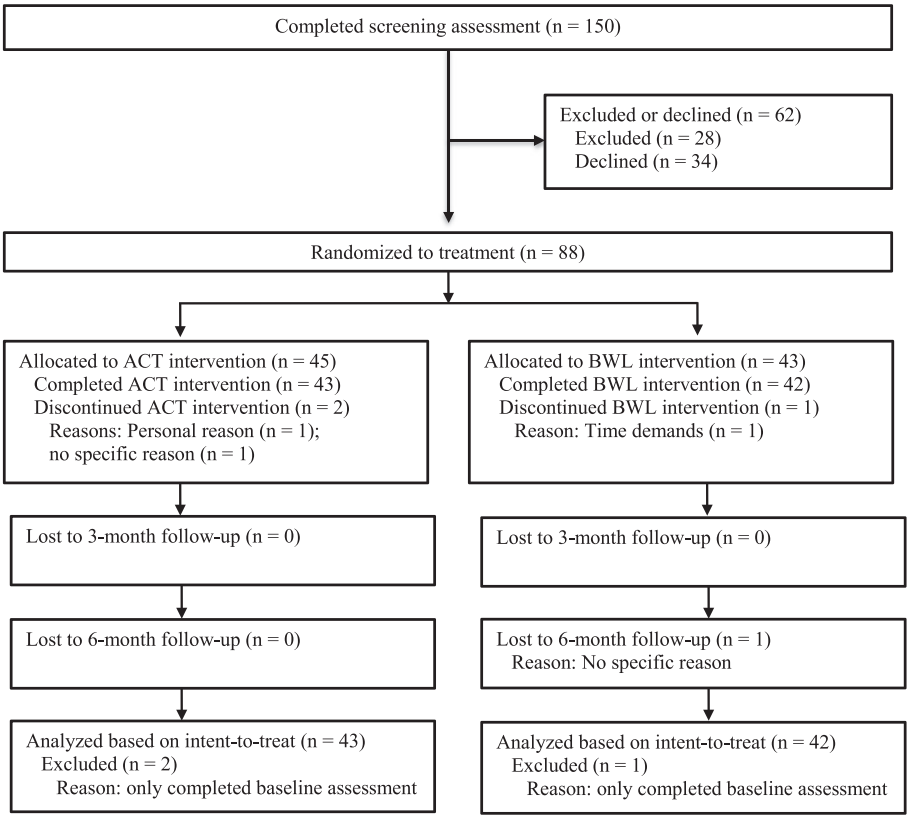

Figure 1 Flow diagram in a randomized controlled trial comparing an acceptance and commitment therapy (ACT) group intervention with a behavioural weight-loss (BWL) group intervention.

sample (n = 80) in the obese range (BMI $\geq$ 30 kg m^2). A total of 9% of the sample (n = 8) met *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* criteria for BED based on the Eating Disorder Examination, and 44% (n = 39) had BES scores 18 and above, indicative of clinically significant binge eating (37).

Treatment integrity, expectancy and acceptability

Average number of sessions attended was high (ACT: 3.5/4; BWL: 3.8/4) with no group differences. Across both conditions, ratings of therapist adherence to treatment were high (M = 99%, SD = 5%). Therapist competence ratings were also high (M = 3.76, SD = 0.18; 0–4 scale). There was no significant difference in adherence to the treatment protocol. However, the BWL therapists (M = 3.85, SD = 0.03) had higher competence ratings than the ACT therapists (M = 3.66, SD = 0.19) [F(1, 22) = 8.12, p = 0.009]. There were no significant differences between groups on treatment expectancy and credibility as measured by the Credibility and Expectations for Improvement Scale. Satisfaction on the 8-point to 32-point Client Satisfaction Questionnaire was high for participants in both ACT (M = 28.84, SD = 3.51) and BWL groups (M = 29.73, SD = 2.91) with no significant differences.

Outcomes

Table 3 presents the means and SDs for each outcome by group and time point. Table 4 shows parameter estimates and 95% confidence intervals for the group-by-time interactions from linear mixed-effects models. The interaction approached significance on the BES [F(3, 83.20) = 2.70, p = 0.051]. Participants in the BWL group exhibited significantly greater decreases from baseline to post-treatment compared with participants in the ACT group ($p < 0.01$) and a non-significant trend for greater decreases from baseline to 3- or 6-month follow-up (Figure 2). There was a significant main effect of time such that both groups demonstrated reductions in BES scores across time [F(3, 84.01) = 16.46, $p < 0.001$], with significantly lower scores at 3- and 6-month follow-up compared with baseline.

There were no significant group-by-time interactions for DEBQ subscales, ORWELL-97, AAQ-W or weight. There were significant main effects of time for DEBQ emotional eating [F(3, 83.44) = 11.14, $p < 0.001$] and

Table 2 Participant characteristics at baseline

Variable	Total (*N* = 88)	ACT (*n* = 45)	BWL (*n* = 43)	*p*-value
Demographics				
Age, M (SD)	57.3 (9.9)	56.5 (10.3)	58.1 (9.5)	0.45
Male, *n* (%)	67 (76.1)	32 (71.1)	35 (81.6)	0.26
Race/ethnicity, *n* (%)				
African–American	17 (19.3)	7 (15.6)	10 (23.3)	0.36
Caucasian	62 (70.5)	32 (71.1)	30 (69.8)	0.89
Hispanic	12 (13.6)	6 (13.3)	6 (14.0)	0.93
Branch of service, *n* (%)				0.18
Army	21 (23.9)	15 (33.3)	6 (14.0)	
Air force	14 (15.9)	6 (13.3)	8 (18.6)	
Marines	13 (14.8)	6 (13.3)	7 (16.3)	
Navy	40 (45.5)	20 (44.4)	20 (46.5)	
Coast guard	2 (2.3)	0 (0.0)	2 (4.7)	
Education, *n* (%)				<0.001
High school	4 (4.5)	1 (2.2)	3 (7.0)	
Some college	26 (29.5)	10 (22.2)	16 (37.2)	
Technical/vocational school	21 (23.9)	17 (37.8)	4 (9.3)	
Bachelor's degree	13 (14.8)	1 (2.2)	12 (27.9)	
Graduate/professional degree	23 (26.1)	15 (33.3)	8 (18.6)	
Clinical measures				
BES, M (SD)	16.3 (8.9)	15.5 (9.3)	17.1 (8.5)	0.42
DEBQ emotional, M (SD)	3.0 (1.0)	3.0 (1.0)	3.1 (1.0)	0.79
DEBQ external, M (SD)	3.2 (0.6)	3.2 (0.5)	3.2 (0.6)	0.88
DEBQ restraint, M (SD)	3.0 (0.6)	3.0 (0.6)	2.9 (0.6)	0.66
ORWELL-97, M (SD)	49.9 (29.2)	48.8 (30.4)	51.0 (28.3)	0.73
AAQ-W, M (SD)	74.0 (19.9)	74.2 (19.8)	73.8 (19.8)	0.92
Weight (lbs), M (SD)	248.5 (57.9)	247.9 (63.1)	249.2 (52.6)	0.92

AAQ-W, Acceptance and Action Questionnaire for Weight-Related Difficulties; ACT, acceptance and commitment therapy; BES, Binge Eating Scale; BWL, behavioural weight-loss; DEBQ, Dutch Eating Behavior Questionnaire; ORWELL-97, Obesity-Related Well Being Scale; SD, standard deviation.

Table 3 Observed means and standard deviations of outcomes by group at each assessment time point

	Baseline		Post-treatment		3-month follow-up		6-month follow-up	
Measure M (SD)	ACT (*n* = 43)	BWL (*n* = 42)	ACT (*n* = 43)	BWL (*n* = 42)	ACT (*n* = 43)	BWL (*n* = 42)	ACT (*n* = 43)	BWL (*n* = 41)
BES	15.7 (9.2)	16.8 (8.5)	13.6 (9.0)	10.6 (7.2)	11.9 (8.6)	10.6 (7.4)	11.9 (7.4)	10.0 (7.6)
DEBQ emotional	3.0 (1.0)	3.0 (1.0)	2.8 (1.0)	2.6 (0.9)	2.6 (1.0)	2.7 (1.0)	2.6 (1.1)	2.5 (1.0)
DEBQ external	3.2 (0.5)	3.2 (0.6)	3.0 (0.6)	2.9 (0.5)	2.9 (0.6)	2.9 (0.6)	2.8 (0.6)	2.8 (0.6)
DEBQ restraint	2.9 (0.6)	3.0 (0.6)	3.1 (0.6)	3.2 (0.7)	3.0 (0.7)	2.9 (0.7)	2.8 (0.7)	2.9 (0.7)
ORWELL-97	49.6 (30.7)	50.3 (28.3)	46.1 (33.5)	42.0 (22.8)	38.9 (29.1)	41.3 (27.0)	36.2 (27.6)	38.0 (32.0)
AAQ-W	74.8 (19.8)	73.5 (20.0)	69.6 (19.8)	66.7 (17.1)	66.8 (17.5)	65.3 (19.1)	67.1 (19.9)	64.6 (20.1)
Weight (lbs)	250.7 (63.0)	249.9 (53.1)	249.6 (64.2)	248.4 (55.7)	246.2 (62.7)	243.8 (51.6)	248.5 (63.2)	246.5 (50.3)

AAQ-W, Acceptance and Action Questionnaire for Weight-Related Difficulties; ACT, acceptance and commitment therapy; BES, Binge Eating Scale; BWL, behavioural weight-loss; DEBQ, Dutch Eating Behavior Questionnaire; ORWELL-97, Obesity-Related Well Being Scale; SD, standard deviation.

external eating subscales [$F(3, 83.99) = 12.01$, $p < 0.001$], with significantly lower scores at post-treatment and follow-ups compared with baseline. There was also a significant main effect of time on the DEBQ restraint subscale [$F(3, 84.10) = 6.63$, $p < 0.001$], with a significant increase in scores from baseline to post-treatment but no differences between scores at follow-ups and baseline. There were significant main effects of time on the

Table 4 Results from linear mixed-effects models comparing differences in change between the ACT and BWL groups at assessment time points

	Mean difference in change from baseline (95% CI)					
	Post-treatment	*p*-value	3-month follow-up	*p*-value	6-month follow-up	*p*-value
BES	4.24 (1.26, 7.22)	0.01	2.52 (−0.42, 5.45)	0.09	2.95 (−0.32, 6.22)	0.08
DEBQ emotional	0.20 (−0.05, 0.46)	0.11	−0.01 (−0.31, 0.29)	0.96	0.16 (−0.20, 0.51)	0.38
DEBQ external	0.13 (−0.09, 0.35)	0.24	0.05 (−0.19, 0.28)	0.69	0.04 (−0.22, 0.29)	0.78
DEBQ restraint	0.00 (−0.22, 0.23)	0.98	0.11 (−0.16, 0.37)	0.43	−0.07 (−0.33, 0.18)	0.57
ORWELL-97	4.83 (−2.95, 12.60)	0.22	−1.74 (−9.86, 6.38)	0.67	−1.50 (−10.79, 7.79)	0.75
AAQ-W	1.68 (−4.46, 7.82)	0.59	0.22 (−5.55, 5.99)	0.94	0.67 (−5.56, 6.89)	0.83
Weight (lbs)	0.49 (−16.9, 17.9)	0.96	−1.41 (−11.3, 8.49)	0.78	−1.13 (−13.2, 10.9)	0.85

AAQ-W, Acceptance and Action Questionnaire for Weight-Related Difficulties; ACT, acceptance and commitment therapy; BES, Binge Eating Scale; BWL, behavioural weight-loss; DEBQ, Dutch Eating Behavior Questionnaire; ORWELL-97, Obesity-Related Well Being Scale.

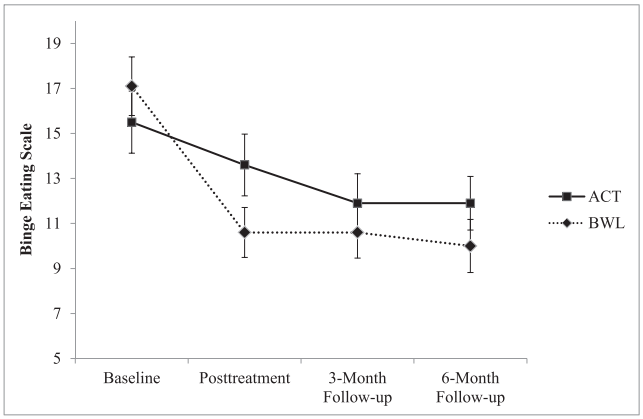

Figure 2 Mean (standard error) scores on the Binge Eating Scale plotted separately by acceptance and commitment therapy (ACT) and behavioural weight loss (BWL) groups.

ORWELL-97 and AAQ-W [$F(3, 83.49) = 11.44$, $p < 0.001$; $F(3, 83.90) = 12.62$, $p < 0.001$, respectively] with significantly lower scores at post-treatment and follow-ups compared with baseline. The model with weight as the outcome did not show a significant main effect of time ($p = 0.08$). Based on the observed pattern of means, a *post hoc* linear mixed-effect model was examined that included time as a quadratic effect. This analysis showed a significant quadratic effect of time [$F(1, 164.73) = 3.91$, $p = 0.05$]. Sensitivity analyses to examine the potential confounding effects of therapist competence revealed that results did not change when accounting for therapist competence ratings. Additionally, *post hoc* analyses including only those with BES scores of 18 and above found similar results as the entire sample.

The relationship between change in AAQ-W scores and BES scores from baseline through follow-up did not differ by treatment group [$b = 0.02$, standard error = 0.05, $p = 0.78$]. This finding was followed by a linear regression analysis, including the main effect of treatment group, to determine the main effect of change in AAQ-W scores on change in BES scores. Changes in AAQ-W scores were significantly related to changes in BES scores [$b = 0.21$, SE = 0.05, $p < 0.001$], indicating that reductions in weight-related experiential avoidance were associated with improvement in binge eating behaviour across groups.

Discussion

To our knowledge, this is the largest randomized controlled trial of ACT as an adjunctive intervention for disinhibited eating (including binge eating) in a primarily male, veteran sample seeking weight-loss treatment. Contrary to hypotheses, the BWL intervention demonstrated greater improvement in binge eating behaviour at post-treatment with non-significant trends for greater improvement at follow-up. Improvement in other disinhibited eating patterns, obesity-related quality of life and weight-related experiential avoidance were similar

between groups. There was a reduction in weight in both groups that returned to baseline levels at 6-month follow-up. Further, reductions in weight-related experiential avoidance were associated with improvements in binge eating behaviour across groups. Together, these findings provide some support for the value of adjunctive intervention for the range of disinhibited eating in veterans who complete *MOVE!*.

As with most ACT interventions, the primary goal of this study's ACT intervention was to reduce experiential avoidance and thereby increase psychological flexibility. Thus, changes in eating behaviour were encouraged only when doing so promoted values-congruent living. Alternately, the BWL group included more specific behavioural strategies to change eating behaviour (e.g. portion control and eating regularly), regardless of attention to disinhibited eating. This may be one reason why the BWL group exhibited greater reductions in binge eating behaviour. It also is possible that ACT as delivered in this study may not be an appropriate intervention for disinhibited eating. However, it is worth noting that participants in the ACT group continued to show decreases in binge eating from post-treatment to 3-month follow-up. This pattern of results is similar to other ACT-based studies that have shown continued improvement in outcomes following treatment (46), including binge eating frequency (23).

There were improvements in other forms of disinhibited eating and obesity-related quality of life across groups and time points with the exception of dietary restraint, which increased at post-treatment before returning to baseline levels at follow-up. This may have been related to participants' recent experience in *MOVE!*, where a primary focus was on diet and food logging. Because dietary restraint is a multifaceted construct with mixed findings as it relates to eating pathology (47), future research should capture multiple components of dietary restraint. In regard to weight, both groups continued to lose some weight with a return back to baseline levels by 6-month follow-up. In light of the extensive literature on weight regain (48), the finding that an adjunctive intervention for disinhibited eating may have extended the period of weight-loss post-*MOVE!* is intriguing. Future studies can further examine other adjunctive treatments and are also encouraged to integrate strategies for behavioural weight loss and disinhibited eating to simultaneously address both concerns.

The finding that both groups improved in weight-related experiential avoidance was unexpected given this process is a purported mechanism of change in ACT and was not overtly targeted in the BWL group. It is possible the cognitive–behavioural strategies taught in the BWL group (e.g. identifying distorted thoughts and identifying barriers to behaviour change) were sufficient to reduce weight-related experiential avoidance. Indeed, other investigators have shown reductions in measures of general experiential avoidance following traditional cognitive–behavioural therapy intervention (46,49). Nonetheless, change in weight-related experiential avoidance was significantly associated with change in binge eating behaviour, suggesting that regardless of intervention type, this construct may be an important factor for reducing binge eating behaviour.

An important contextual feature of the present study was that all participants recently completed the *MOVE!* programme. While the BWL group was an extension of previously learned material, the ACT concepts were likely novel to most participants. Additionally, the participants were in their late 50s on average, and the vast majority had BMI in the obese range. Although ACT interventions of shorter duration have shown some promise (33), longer treatment duration may be necessary when using similar 'adjunctive treatment' designs, especially with weight-loss-seeking male veterans who may be older and have had years of engrained eating patterns. Previous investigations showing superior results of ACT-based interventions over standard behavioural weight-loss programmes have included 32–40 treatment sessions (24,25). Further, it remains inconclusive if providing adjunctive treatment prior to, following, or concurrent with a weight-loss intervention is the most optimal approach (28,50,51). There is emerging support for models combining ACT with standard behavioural treatments to reinforce key aspects of behaviour change (52). Future studies may consider integrating ACT methods and other strategies that directly address binge eating into established weight-loss programmes for a comprehensive treatment protocol to address disordered eating in a larger sample of veterans with obesity and clinically significant binge eating.

This trial evaluated ACT for disinhibited eating in a sample of veterans whom were primarily male. Disinhibited eating including binge eating has been understudied in both male and veteran populations (5). Further, compared with community samples, veterans may be at greater risk for disinhibited eating patterns (12). Participants reported high satisfaction with both interventions, and there was extremely low dropout from treatment and high attendance at nearly every session. It is promising that both the ACT and BWL interventions were acceptable to this primarily male sample and produced significant improvements on measured outcomes across most time points among these veterans.

This study has several limitations. First, the majority of participants did not have substantial binge eating, and participants were recruited for a range of disinhibited

eating behaviour. Results may have differed had all participants reported clinically significant levels of binge eating or met full diagnostic criteria for BED. Second, there were differences in therapist competence. Although results remained similar when controlling for competence, therapist competence and expertise have been shown to be particularly important when examining acceptance-based interventions (24). Third, study findings may not generalize to civilian samples or samples that are primarily women. Finally, while homework was a component of and emphasized in both interventions, homework completion was not recorded as a means of providing evidence that each treatment was enacted.

Conclusions

ACT as an adjunctive treatment to *MOVE!* demonstrated similar improvements as a continued BWL intervention, with the exception of binge eating severity at post-treatment. Regardless of intervention type, participants who took a more accepting stance towards inner experiences related to eating and weight also showed improvements in binge eating severity. Future research is encouraged to determine if longer treatment duration of ACT or more comprehensive integrated treatment protocols yield greater treatment response over other interventions among veterans with obesity and eating concerns.

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Conflict of Interest Statement

The authors declare no conflicts of interest.

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